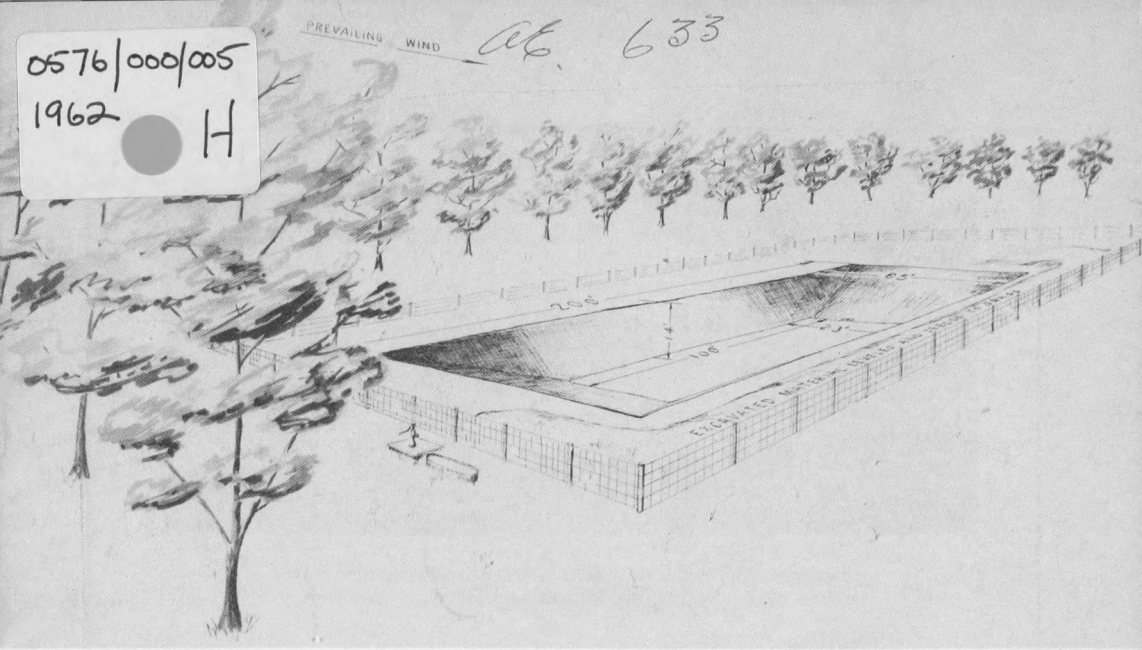


WATER DEVELOPMENT

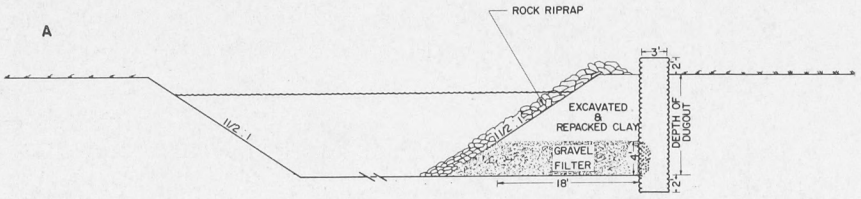
under the

Prairie Farm Rehabilitation Program

- Dugouts
- Stockwatering Dams
- Irrigation Projects

CANADA DEPARTMENT OF AGRICULTURE

FILTER SYSTEMS FOR HOUSEHOLD WATER



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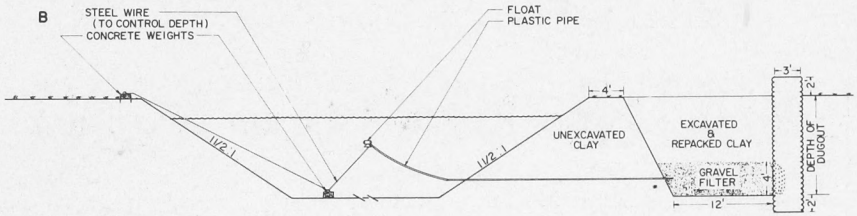

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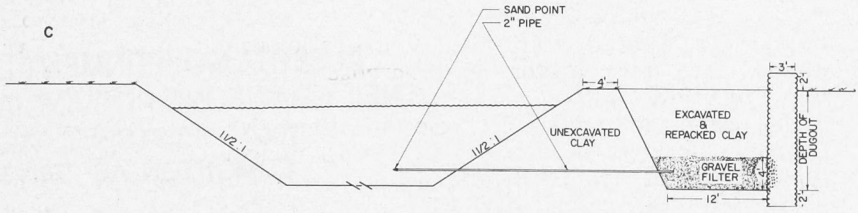

Type 'C'—see page 7.

Front Cover - Artist's conception of the ideal dugout and treebelt.

Proper location of this farm dugout has caused it to fill to overflowing. Note fence to protect the water from contamination by animals.

Water Development

under the

Prairie Farm Rehabilitation Program

UNDER the terms of the Prairie Farm Rehabilitation Act, engineering and financial assistance is made available to farmers in the three prairie provinces for the development of surface water supplies for domestic, stockwatering and irrigation purposes. The object of the program is to assist prairie farmers in making the most efficient use of surface water which would otherwise be wasted in major watersheds or lost by evaporation.

The main source of surface water is spring runoff from melting snow. Approximately 80 per cent of the surface water available for use is derived from this source. However, unless positive methods are used to store or otherwise utilize this runoff water, it is generally wasted.

The three main types of projects built under this program are dugouts, stockwatering dams and small irrigation schemes. The type of project will be determined largely by topographical characteristics of the surrounding land area and the purpose for which the project will be used. On the other hand, the size of the project will depend mainly upon the water yielding ability of the watershed, and the water supply required for stockwatering, irrigation and/or domestic use.

Under prairie conditions of sun and wind, water supplies stored in surface reservoirs, when properly located and managed, can provide good quality water; in many instances superior to that which can be obtained from local wells. If properly designed, such water development facilities should be able to meet all immediate farm requirements and provide adequate water supplies over dry periods, extending for two to three years.

Lush growth in the farmyard, and ample tree belts are maintained by water from this dugout south of Regina.

DUGOUTS

Probably the most common type of reservoir used for water storage on the prairie farm is the dugout, consisting of a simple excavation in the ground located in a watershed area which will yield an adequate supply. Practically every farm has one or more suitable sites where dugouts can be located, but to be effective there are several factors which should be taken into consideration before actual construction of the project is undertaken.

Storage Requirements

The dugout should have a storage capacity to satisfy all probable uses for which water from it may be required. For example, if the project is to be used strictly for stockwatering, its storage requirements may not be as great as they would be if the water supply is also to be used for garden, shelterbelt and lawn irrigation, as well as for domestic purposes. To help estimate requirements, a few rules of thumb may be useful.

1. Seepage and evaporation generally waste approximately one-third of the water stored in a dugout.
2. Dugouts which are intended for winter use should have additional provision to compensate for the loss of usable water due to ice formation.
3. Approximately 1 acre-foot of water will supply the annual requirements of about 25 head of cattle or corresponding numbers of other livestock.
4. The average farm home with pressurized water supply system and modern plumbing facilities installed, will require from 1 to 1½ acre-feet of water per year to meet domestic requirements.
5. Where a reservoir is intended to supply water for supplemental irrigation purposes, provision should be made for at least 1 acre-foot of storage for every 2 acres of land to be irrigated. A dugout containing 2 acre-feet of usable water, therefore, will provide limited irrigation for up to 4 acres of garden and shelterbelt.

Conditions of Watershed

In order to assure the continued effective use of the storage reservoir, it is advisable to study carefully the nature and conditions of the watershed which is to supply the water. Some of the more important points to consider in this regard include the following:

1. *Gradient and condition of drainage area.*—Steep slopes on a finely tilled field will result in soil erosion during the spring runoff period. Silt carried into the dugout will substantially reduce the term of its usefulness.
2. *Location and condition of natural tributaries.*—Water courses that drain into the dugout should be grassed to prevent excessive silting, and care should be taken to ensure that drainage from areas that could cause pollution is not allowed to enter the reservoir.
3. *Location of snow traps.*—Good snow traps will help to assure a dependable water supply for the reservoir. For example, a stubble field will usually produce twice as much runoff as a summerfallowed field. Natural snow traps such as trees and coulees are also effective. Where little or no snow trap conditions exist, it may be well to construct the dugout near planted tree shelterbelts or erect snow fences to help catch the snow.
4. *Water supply requirements for an average-size dugout.*—To assure a dependable water supply, a dugout with a storage capacity of 2 acre-feet, or approximately 550,000 gallons of water, will require a drainage area of about 50 acres of land. As indicated above, however, this requirement can be substantially reduced where special snow catching devices are utilized.

Choosing the Site

Not only should the dugout be in the best possible location to catch the maximum amount of available runoff water, but it should also be located so that drainage from barnyards, feedlots or refuse deposits will not pollute the water in the dugout. Furthermore, consider all probable uses so that the dugout will be placed in the

This small dam impounds a dependable water supply for stockwatering, irrigation and domestic use.

most convenient and advantageous location for domestic, livestock, irrigation and other uses. A dugout placed in a slough or other marshy hollow will be inaccessible for a good part of the year and will not lend itself readily to development for domestic purposes.

Size of the Dugout

The uses for which it is intended and the usable drainage area will largely determine the maximum size of the dugout. However, for general all round usefulness, and to gain maximum benefits from the assistance provided by PFRA, the dugout should be at least 14 feet deep with surface dimensions not less than 65 feet in width and 200 feet in length, with provision for end slopes of 4 to 1 and side slopes of 1½ to 1. If constructed according to these dimensions, the bottom of the dugout should measure not less than 23 feet wide and 85 feet long. A dugout of this size will require the excavation of at least 3,550 cubic yards of earth.

Subsurface Soil Conditions

Excessive seepage will seriously limit the effectiveness of a water storage reservoir. Before actually starting the excavation, it is well to drill test holes in the corners and in the center of the intended dugout, to determine the soil type. Clay or clay mixture soils are generally considered the most suitable since clay will seal the walls and the bottom of the dugout and thus reduce seepage to a minimum. Where the soil is very porous, but the site is otherwise ideally suited, it may be desirable to consider lining the dugout with clay, plastic sheeting or other impervious material to prevent excessive seepage.

Construction of the Dugout

Excavations of considerable volume can be quickly and efficiently accomplished with the use of mobile earth moving equipment, such as the track-type tractor and scraper unit, the self-propelled scraper or the dragline. Equipment of this type can excavate the earth very quickly and also bank, spread, or level the loose earth. Loose earth should not be left near the edge since rains will wash this soil into the dugout. The spoil dirt should be kept at least 10 feet from the edge of the dugout, levelled into the form of a low berm, and should be seeded to suitable grass or grass-legume mixtures. Care should be exercised to assure stability of the side slopes of the dugout. These slopes should not be steeper than 1½ to 1 on the sides or 4 to 1 at the ends.

Protection

Where a dugout is to be used for domestic as well as stockwatering purposes, or where soil conditions are such that direct stockwatering will damage the structure, it is essential to provide a fence capable of keeping out domestic animals. A strong protective fence not only prevents pollution, it also lengthens a dugout's period of usefulness.

In addition, a strong fence is an essential feature from a safety standpoint both for animals and people. Where children play nearby, it is advisable to equip the dugout with a lifesaving device. A

throwing buoy, attached to a good length of ¼-inch rope, should be placed in a prominent position near the edge of the dugout. A good pole or plank, or merely a length of rope at the side of a dugout, may save someone's life.

Filter Systems for Household Water

Where the dugout water is intended for household supply, it is necessary to install a filter system. There are three types of filter systems recommended for general use. The specific type to be employed will depend on the individual situation.

Type 'A' Filter—The most common and the simplest filter to install is the full length filter trench system. A well is dug a short distance from the edge of the dugout and then connected to the dugout water supply by way of a gravel filter trench. In order to assure a good supply of filtered water, the well should be 4 feet in diameter and dug to a depth at least 3 feet below the dugout bottom. The well cribbing should rest on a layer of small stones to allow the water to enter the well beneath the cribbing. The well should be on a high point of ground to prevent flooding. It should be at least 30 feet from the edge of the dugout to prevent the well cribbing from being damaged by frost pressure. The latter may reduce the flow of water from the filter trench into the well.

The filter trench should be at least 2 to 3 feet wide and the bottom should be backfilled with 4 feet of clean gravel and sand suitable for filter purposes. The area where the trench enters the dugout, and the bank above it, should be covered with rock riprap to prevent clay from sliding down and eventually sealing off the filter intake.

WARNING—Extreme caution should be exercised in deep trench excavations with vertical side walls. Caving can cause serious injury or even death to workmen in the trench. It is strongly suggested that the side walls be either back-sloped or properly cribbed to prevent accidents. One disadvantage of this type of filter is the difficulty in cleaning it when it becomes clogged with silt. Proper cleaning requires that the dugout be empty in order that the silted material at the dugout end of the filter may be replaced with clean filter material. (See diagram, inside front cover).

Type 'B' Filter—The filter trench used with a type-B filter does not extend all the way from the well to the dugout. The water is fed into the filter through a 1½-inch plastic pipe which extends through the clay bank and into the dugout for 30 to 40 feet. Its free end is suspended from a float so that it will draw water from 2 to 3 feet below the surface. The best quality water is obtained at this level and it will be free of sediment as well. An added advantage in using this type of filter is that the end of the pipe can be lifted out of the water, shutting off the flow when it is necessary to clean or service the well. This intake can also be lowered below ice level to assure free water flow to the filter for winter use. (See diagram, inside front cover).

Type 'C' Filter—The sandpoint type makes it possible to connect a filter well to a dugout which is already full of water. A common sandpoint is attached to the required length of pipe which is advanced through the clay bank by jacking or driving, auguring

or jetting it horizontally from the filter trench to the dugout. It should enter the dugout approximately 2 feet from the bottom to allow for subsequent silting. Another method which can be used to connect a filter well to a full dugout is by advancing a straight pipe through the clay bank, in the manner described above, and then using the pipe as a sleeve through which plastic tubing is fed into the dugout to be used as described in type 'B'. (See diagram, inside front cover).

Treatment

One of the problems which arises in using well water in the home is the presence of tastes and odors that develop from decaying organic matter. Leaves from trees surrounding the dugout, or grass and weeds growing adjacent to it are forms of organic matter which may cause trouble, but more frequently this problem results from the growth of algae, a form of plant life which gives the water a greenish tinge or causes scum to develop on the surface. To control algae growth, 1 pound of copper sulphate for each 100,000 gallons of water should be dispersed throughout the dugout every few weeks during the summer. Copper sulphate will dissolve quickly and can be applied to a dugout by drawing a cloth bag with the chemical in it, around the dugout so that the chemical will be distributed uniformly.

STOCKWATERING DAMS

Where topography is suitable, small dams may be constructed across coulees, gullies or watercourses to catch and store spring runoff water. Such structures make effective water storage facilities. Careful survey and planning must be undertaken, however, to ensure that the design and site chosen for construction of the dam is best suited to the conditions prevailing on the watershed on which the structure is to be located. For this reason, PFRA will provide the necessary technical staff to do all the surveying and prepare

More efficient use of pasture is possible with irrigation systems such as this one near Brooks, Alta.

This is the Brown Hill Dam near Grenfell, Sask., which supplies water for various agricultural and community uses.

the necessary plans required in order to construct the project in accordance with regulations pertaining to Water Rights.

IRRIGATION

Irrigation has been defined as the artificial application of water to soil for the purpose of supplying the moisture essential to plant growth. Throughout the drier areas of the prairies this can mean fairly intensive irrigation in order to meet crop requirements. Further north, under better moisture conditions, this usually involves a supplementary form of irrigation when water requirements of plants are at a peak, or when additional water is needed to carry crops over short, dry periods. To serve these various needs, the two most common forms of irrigation practiced on the prairies are surface flooding and use of sprinklers.

Surface flooding or gravity irrigation may involve the use of border dykes, border ditches, border checks, contour ditches, contour dykes and/or furrows, for spreading water on the land. The technique used will depend mainly on the topography of the area to be irrigated, availability of water supply, and cost of land preparation in relation to value of crops grown.

With the extension of rural electrification in recent years, and in view of improvements which have been made in pumps and motors, the use of sprinklers for irrigation has also become more widespread. Portable sprinkler units, with or without lightweight pipe or plastic hose, can now be purchased for the irrigation of farm gardens, lawns and shelterbelts, and limited acreages of hay or cereal crops. Large systems may be installed where bigger and more permanent water supplies are available.

As in the case of stockwatering dams, free technical services are provided by PFRA to handle the survey and prepare the plans necessary for such irrigation development.

PFRA ASSISTANCE POLICIES

Since the boundaries of PFRA were extended in 1961, PFRA assistance in water development is now available to farmers in all settled areas of Alberta, Saskatchewan and Manitoba. This includes technical services and financial aid to the extent that staff and funds are available in any given year, with the amount of assistance provided varying proportionately to the type and size of the project and the ability of farmers to contribute.

Applications for assistance should be submitted on an application form provided for the purpose, to the Chief, Agricultural Services, PFRA, Regina, Sask., or to one of the PFRA field offices listed on the outside back cover of this publication. Application forms are available from:

(a) PFRA—Regina, Sask.
(b) All PFRA field offices.
(c) Municipal and County offices.
(d) Offices of Agricultural Representatives and District Agriculturists.

Acceptance of applications and financial aid are in all cases subject to authorization under the Water Rights Act of the Province in which the project is to be located (with the exception of individual farm dugouts which are exempt), and subject to the project being constructed satisfactorily in every respect. In this connection, such applications are not considered final until the completed project has been inspected and approved by PFRA field staff.

Individual Farm Projects

In this category are included projects built to serve individual farms. Assistance in such cases is supplied on a self-help basis with the farmer being responsible for the actual construction of the project and PFRA supplying agricultural and technical services as required, and paying a portion of the cost of construction.

Dugouts.—In the case of dugouts designed for individual use, the applicant is held responsible for his own site selection including drilling to test for soil conditions and making his own arrangements for the actual construction of the project. Also, to qualify for financial assistance, the constructed dugout must have a minimum depth of 12 feet and should involve not less than 2,500 cubic yards of excavation. Under certain special circumstances, exceptions to this rule may be made on the approval of the local PFRA field representative (i.e.—the existence of high water table conditions in the area where a dugout is to be located).

If constructed to specification, PFRA will pay a portion of the cost of construction calculated on the basis of 7 cents per cubic yard of earth excavated, to a maximum of $250.

Stockwatering Dams.—Financial assistance on the construction of stockwatering dams is paid subject to construction being authorized by Water Rights and the project being built in accordance with specifications and plans prepared by PFRA. The rate of financial assistance paid on this type of development is again calculated on the basis of 7 cents per cubic yard for earth work, 25 cents per cubic yard for rock riprap, and cost of materials purchased, to a maximum of $300 including earth, rock and materials.

Irrigation Projects.—Financial assistance paid on the construction of irrigation projects is again subject, as in the case of stock-watering dams, to construction of the scheme being authorized by Water Rights and the project being built in accordance with specifications and plans prepared by PFRA. Also, the awarding of financial aid is limited to projects where it can be firmly established that a dependable water supply is available for the irrigation of not less than 5 acres of land. For the most part, therefore, farm dugouts would not fall into this category.

Subject to these qualifications, financial assistance for irrigation projects will be paid at the rate of 7 cents per cubic yard for earth excavated, plus 25 cents per cubic yard for rock work and cost of culverts and gates, to a maximum of $600, including earth, rock and materials. While fluming necessary to transport water from the source of supply to the land to be irrigated qualifies for assistance, sprinkler heads and associated facilities required to spread the water through sprinkler irrigation cannot be claimed.

Repairs.—Financial assistance for repairs to small projects may be recommended where required as a result of flood damage or other natural causes within a year after the project is completed. Basis for this assistance is 7 cents per cubic yard for earth, and 25 cents per cubic yard for rock work and cost of materials, to a maximum not exceeding 50 per cent of the total financial assistance which may be paid initially on such facilities. Consideration may be given to extending the one-year period where there is evidence that a project has not been filled to capacity within one year after completion, owing to limited runoff. Assistance for repairs must be limited to repairs of works previously covered by financial assistance from PFRA and must not include expenditures for enlargements or betterments.

Only fence indicates the location of this dugout near Wilcox, Sask., which is completely filled with snow.

Enlargements, Improvements or Betterments.—Financial assistance may be recommended for enlargements, improvements or betterments of small projects where it is found advisable to increase the capacity or ensure greater safety, provided the maximum, including all previous payments, does not exceed $250 for a dugout, $300 for a stockwaternig dam, and $600 for an individual irrigation project.

NOTE: The number of projects permitted on an individual farm is governed by field staff approval of agricultural requirements.

Neighbor Projects

Where two or more individuals find it to their advantage to pool their water resources, financial assistance may be granted on the same basis as for an individual project, but to a maximum of $1,000 including earth, rock and materials. Joint ownership of neighbor projects is essential.

Community and Municipal Projects

Applications for community projects submitted by municipalities or other legally constituted organizations such as Water Users Associations, will be considered for assistance on the basis of their individual merit following a thorough agricultural and engineering survey. When approved, PFRA will assume responsibility for establishing the location, designing and supervising construction of the project. Construction of such projects is usually handled by contract, and due to their size, the major share of cost is borne by PFRA. In turn, the municipality or Water Users Association is required to obtain control of the necessary land and right-of-way required for the project, and accept responsibility for the operation and maintenance of the project effective one year following completion of construction.

PFRA WATER DEVELOPMENT FIELD OFFICES

MANITOBA

Brandon
Dauphin

ALBERTA

Medicine Hat
Fort Macleod
Red Deer
Hanna
Wainwright
Peace River

SASKATCHEWAN

Melville
Weyburn
Melfort
Moose Jaw
Gravelbourg
Swift Current
Shaunavon
Maple Creek
Biggar
North Battleford
Lumsden

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